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# Golden Eagle Territories and Ecology at Site 300

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# GOLDEN EAGLE TERRITORIES AND ECOLOGY

## AT SITE 300

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## TABLE OF CONTENTS

Introduction.....	1
Study Area .....	1
Methods.....	1
Results.....	3
Tesla Territory .....	3
Linac Road.....	7
Ground Squirrels at Site 300.....	8
Discussion.....	9
Future Study.....	11

## FIGURES

Figure 1. Site 300 and Observation Points.....	2
Figure 2. Site 300 ground squirrel survey routes.....	4
Figure 3. Tesla Territory and common perch, soaring and undulating areas .....	5
Figure 4. Total number of ground squirrels observed by study segment and month. ....	8

## TABLES

Table 1. Numbers of Golden Eagles Observed in 2015 in the Tesla Territory .....	6
Table 2. Observed Incidences of Territorial Behavior by the Tesla Pair by Month during 2015. ....	7

## APPENDICES

Appendix A: 2015 Site 300 Golden Eagle Survey History
Appendix B: 2015 Site 300 Golden Eagle Observations



## Introduction

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Garcia and Associates (GANDA) was contracted by the Lawrence Livermore National Laboratory (LLNL) to collect information on golden eagle (*Aquila chrysaetos*) use of Site 300. During 2014, we conducted surveys at Site 300 and for an area including a 10-mile radius of Site 300. Those surveys documented 42 golden eagle territories including two territories that overlapped with Site 300. These were named ‘Tesla’ and ‘Linac Road’. In 2015, we conducted surveys to refine the territory boundaries of golden eagle territories that overlapped with Site 300 and to document eagle activity at Site 300.

Specific questions we attempted to address with the 2015 surveys included the following:

- Were territories observed in 2014 consistently occupied in 2015?
- Did territories overlapping with Site 300 change in size over the course of the nesting season?
- Are there any known nest locations for the observed golden eagle territories?
- How are golden eagles using Site 300?
- Are non-territorial adult golden eagles (floaters) regularly present at Site 300? Are they tolerated by territorial eagles?
- How do non-territorial eagles use Site 300?
- What are the most common behaviors observed?
- Is there differential area use within Site 300?

## Study Area

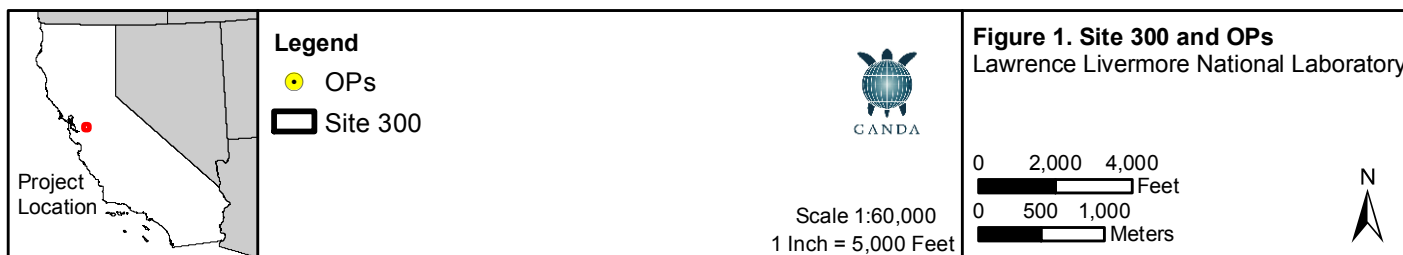
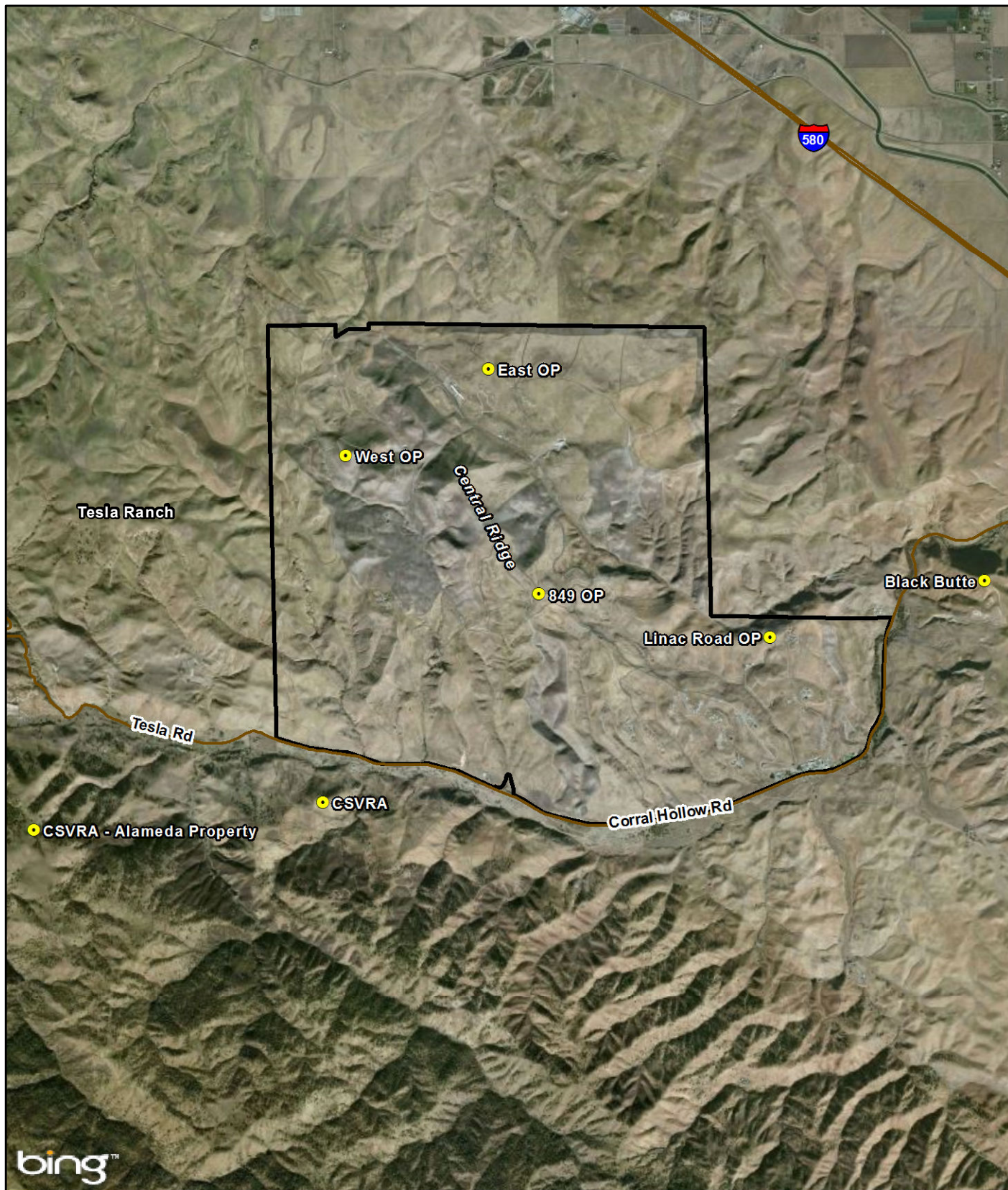
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The study area included all areas within Site 300 as well as adjacent lands within the viewshed of Site 300 observation locations. Observations locations included four main points in Site 300: West Observation Point (WOP), East OP (EOP), Linac Road (LRD), and Building 849 (849). Observations were also made from the access roads between the main observation locations as well as from neighboring properties to the south of Site 300 (Figure 1).

## Methods

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Golden eagle biologists Eric Jepsen, Teresa Hunt, and Brittney Wendell conducted bimonthly golden eagle surveys at Site 300 from January through August 2015 (Appendix A). Surveys documented all golden eagle courtship and territorial behaviors, including high soaring, undulating flights, copulation events, and aggressive chasing of other eagles. All observations were “spot mapped” on a paper map. To the extent possible, the direction of flight, altitude, and age class (juvenile, subadult, adult) of all observed eagles was recorded. We also recorded and documented any perched eagles. Eagle hunting activity was recorded including the targeted prey species if possible. For hunting activity, the style of hunting (contour, hover, stoop) was recorded along with the outcome if possible (captured, missed).





Concurrent with golden eagle surveys, GANDA was also separately contracted to conduct avian point counts at each of the observations points (OPs). This contract was separately funded and not directly connected to the golden eagle surveys. During these avian point counts, we opportunistically recorded all observed eagle activity and included this information in the golden eagle survey data. While avian point count observations were limited by the point count protocol, these survey data increased the number of observation days and the level of information regarding golden eagle activity at Site 300. Where possible, we also recorded golden eagle observations outside of protocol surveys and included them in the results. A full summary of golden eagle observations is provided in Appendix B.

While conducting surveys, we documented ground squirrel (*Otospermophilus beecheyi*) activity along the routes between observation points. Five survey routes were designated (Figure 2), to identify areas south (1), west (2), east (3), and north (4) of the Central Ridge, and the Linac Road area to the southeast (5). Data recorded included a count of the number of ground squirrels along predetermined segments of each route. Squirrel observations were limited to those visible from the vehicle. Vehicle speed was maintained at or under 20 miles-per-hour and vehicle windows were open to enable the surveyors to hear ground squirrel calling. Distance between the vehicle and the squirrels was not recorded, nor did we pre-determine a limit to the distance of visible ground squirrels we recorded. These data were summarized to provide a baseline assessment of ground squirrel use at Site 300 and to provide insight into eagle foraging strategies.

## Results

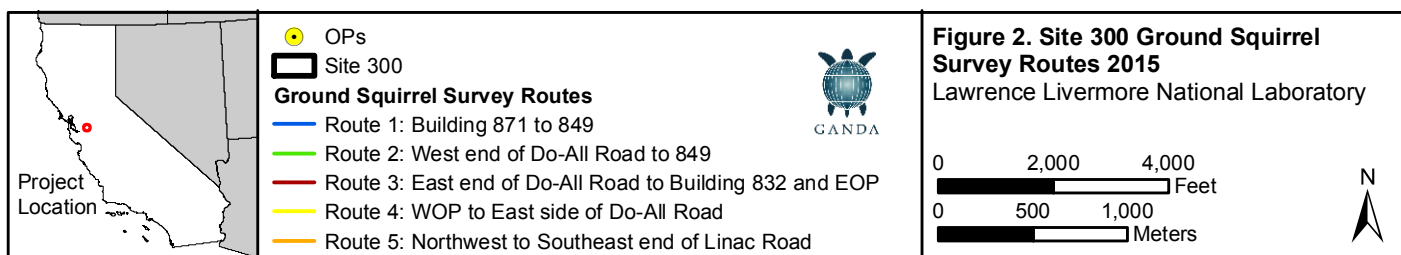
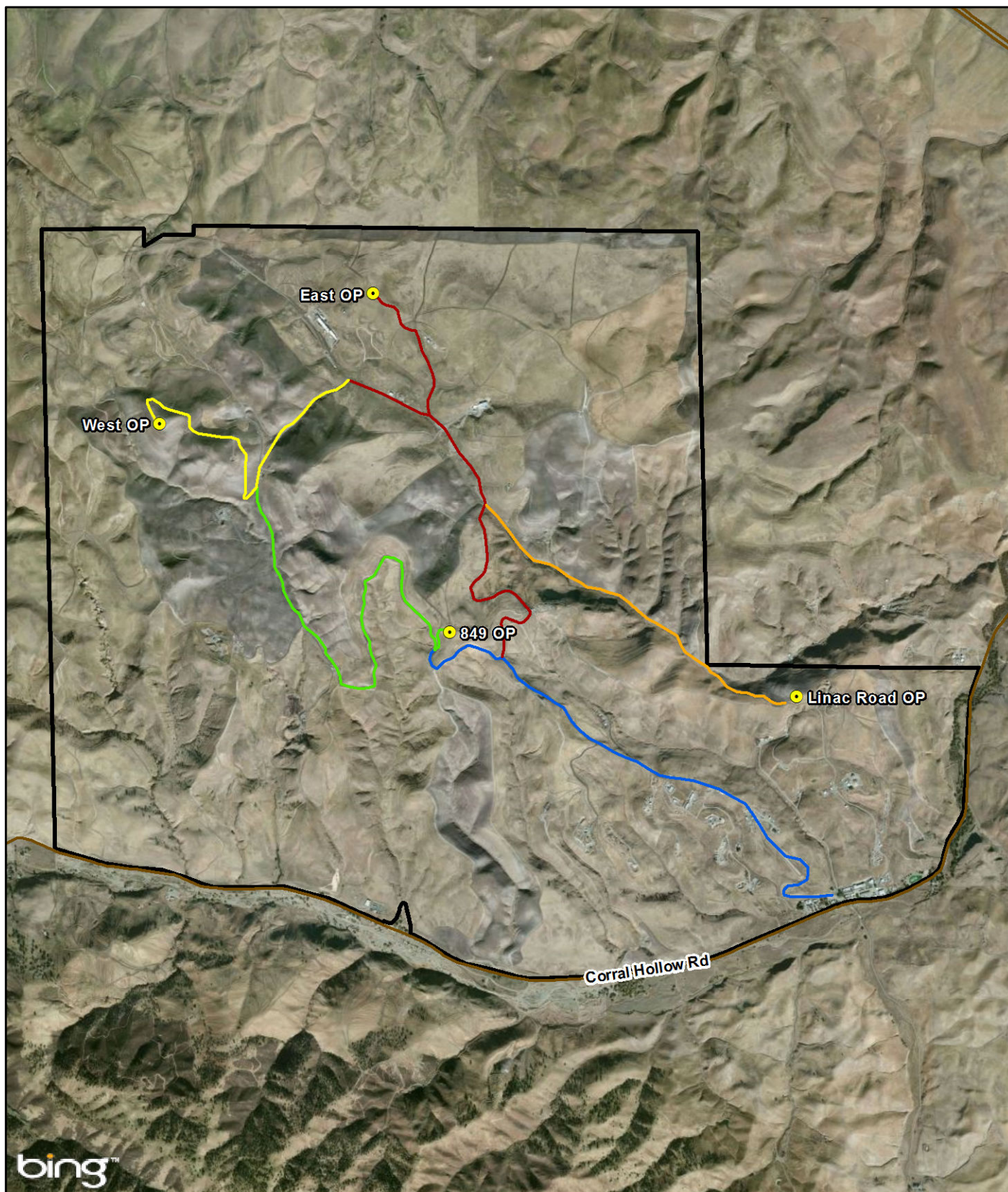
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From January through August, 2015 we conducted golden eagle surveys at Site 300 twice monthly for a total of 86 hours across 16 survey dates, with an average of 5.4 hours per survey. In addition to golden eagle surveys, we also opportunistically collected eagle observations during avian point counts conducted monthly for a total of 60 hours across 8 survey dates.

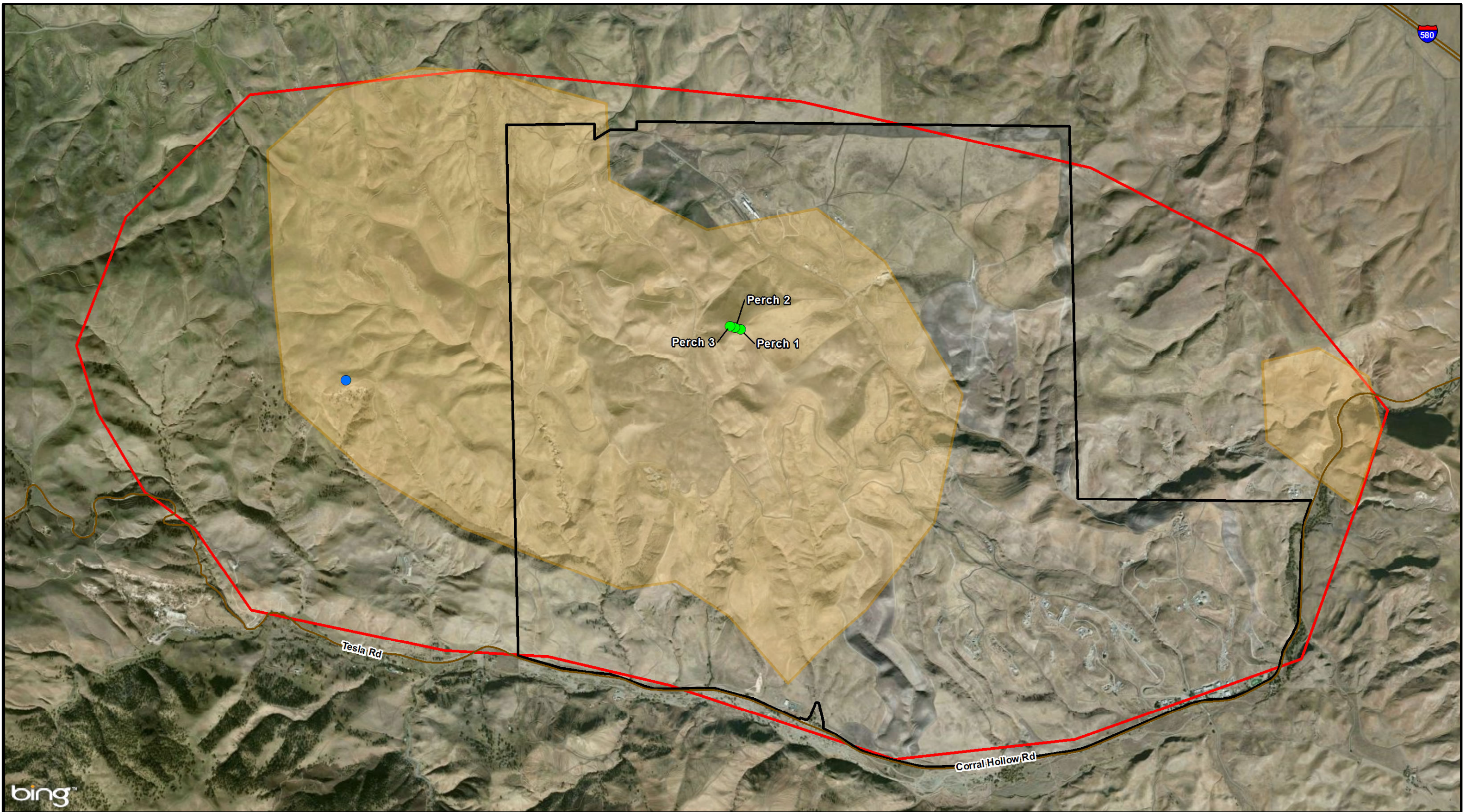
In 2015, only one consistently occupied golden eagle territory was observed. From the first survey conducted in January, the Tesla territory was evident, with regular presence of territorial adult eagles consistently perched, soaring, undulating, and defending areas consistent with 2014 observations. Linac Road observations were similar to those of 2014, indicating that this area is not occupied (consistently or ever) by territorial golden eagles. A summary of observations from each territory is presented below.

### *Tesla Territory*

The Tesla golden eagle territory occupies an approximately 18.8-square-mile area extending 3 miles north of Tesla/Corral Hollow Road, and includes most of Site 300 and the area 2 miles to the west of the western Site 300 boundary (Figure 3). Territory size did not appear to vary from month to month. Within this general area, territorial adults were consistently observed perched, soaring, undulating, hunting, and chasing other eagles during every month of the survey period. The average number of eagle observations in the Tesla territory was 11.6 eagles per month, ranging







Project Location

**Legend**

- Copulation
- Favored Perch
- Undulations
- Soaring Area
- Site 300

The U.S. Fish and Wildlife Service defines important eagle use areas as “an eagle nest, foraging area, or communal roost site that eagles rely on for breeding, feeding or sheltering” (Federal Register 2013 Vol. 78 No 236). Observations made in 2015 confirm that Site 300 overlaps with an important eagle use area, outlined in red in this Figure. Risks to eagles from wind developments at Site 300 would include direct mortality, disturbance that results in loss of productivity, and loss of eagle territory. Consider data in this subcontract report historical after 2025. LLNL-SR-677643.

Scale 1:30,000  
1 Inch = 2,500 Feet

**Figure 3. Composite Map of 2015 Territorial Observations**  
Lawrence Livermore National Laboratory

02,0004,000

Feet

05001,000

Meters

N



from a high of 22 eagle observations in January to a low of five eagle observations in May (Table 1). One instance of copulation was observed on the high ridge approximately 0.9 mile west of the western Site 300 boundary, on February 23, 2015. Observations of territorial behavior averaged 10.5 events per month. (Table 2).

No nesting activity was observed at Site 300. Over the course of the breeding season, there was no noticeable change in behavior to indicate that the Tesla golden eagle pair successfully proceeded past the nest-building stage. Both adults were visible for extended periods during all survey months, indicating that incubation did not occur. Other evidence supporting the lack of successful breeding included that no juvenile golden eagles with fresh plumage were ever observed soaring or perched with the territorial adults during the latter part of the season.

Table 1. Numbers<sup>1</sup> of Golden Eagles Observed in 2015 in the Tesla Territory

<b>Year: 2015</b>				
<b>Month</b>	<b># adults</b>	<b># subadults</b>	<b># unknown</b>	<b>Total</b>
January	11	6	5	22
February	8	1	1	10
March	7	4	0	11
April	7	7	0	14
May	3	1	1	5
June	10	3	0	13
July	6	0	0	6
August	12	0	0	12
<b>Tesla Total</b>				<b>93</b>

<sup>1</sup>These numbers may represent repeat observations of the same individuals.

Table 2. Observed Incidences<sup>2</sup> of Territorial Behavior by the Tesla Pair by Month during 2015.

<b>Year: 2015</b>							
<b>Month</b>	<b>Perched</b>	<b>Soaring</b>	<b>Copulation</b>	<b>Undulation</b>	<b>Chasing/Escort</b>	<b>Hunting</b>	<b>Total</b>
January	4	9	0	1	0	1	15
February	3	3	1	3	0	1	11
March	3	5	0	2	0	1	11
April	4	5	0	3	2	2	16
May	0	2	0	0	0	1	3
June	2	2	0	1	2	3	10
July	3	2	0	1	0	0	6
August	4	4	0	1	1	2	12
<b>Tesla Total</b>							<b>84</b>

<sup>2</sup>Values in the table represent the number of observations of each territorial behavior type. Where the value is greater than one, the observations represent the cumulative total which may include multiple eagles.

Golden eagle hunting activity appeared to center on ground squirrel colonies surrounding the north side of the Central Ridge. On most days, one or both adults of the Tesla pair were observed perched atop one of three wooden power poles on the north side of the Site 300 Central Ridge (Figure 3). This perch location is visible from all Site 300 observation points except for 849. During some surveys, the eagle(s) remained perched at this location for hours. During other surveys, the eagles used this location as a central perch from which to launch hunting forays into the surrounding ground squirrel colony, or territorial flights in all directions.

We observed territorial flights by the Tesla pair, including soaring and undulations throughout Site 300 and extending to areas approximately 2 miles west of Site 300 (Appendix B). On occasion, one or both adult golden eagles soared high to the west of Site 300, and then undulated southwest to 849 or the preferred perch on the north side of the Central Ridge. At other times, undulations were low and tight over the ground squirrel colonies surrounding the preferred perch area. Other eagles were in general, ushered out of the territory. On one particular observation date (April 14, 2015), five subadult golden eagles were observed passing through Site 300 from the southeast toward the northwest. One of the adult golden eagles was observed on this date flying with several of these birds, as they headed north, and then circling back to perch at the Central Ridge wooden power pole location.

### ***Linac Road***

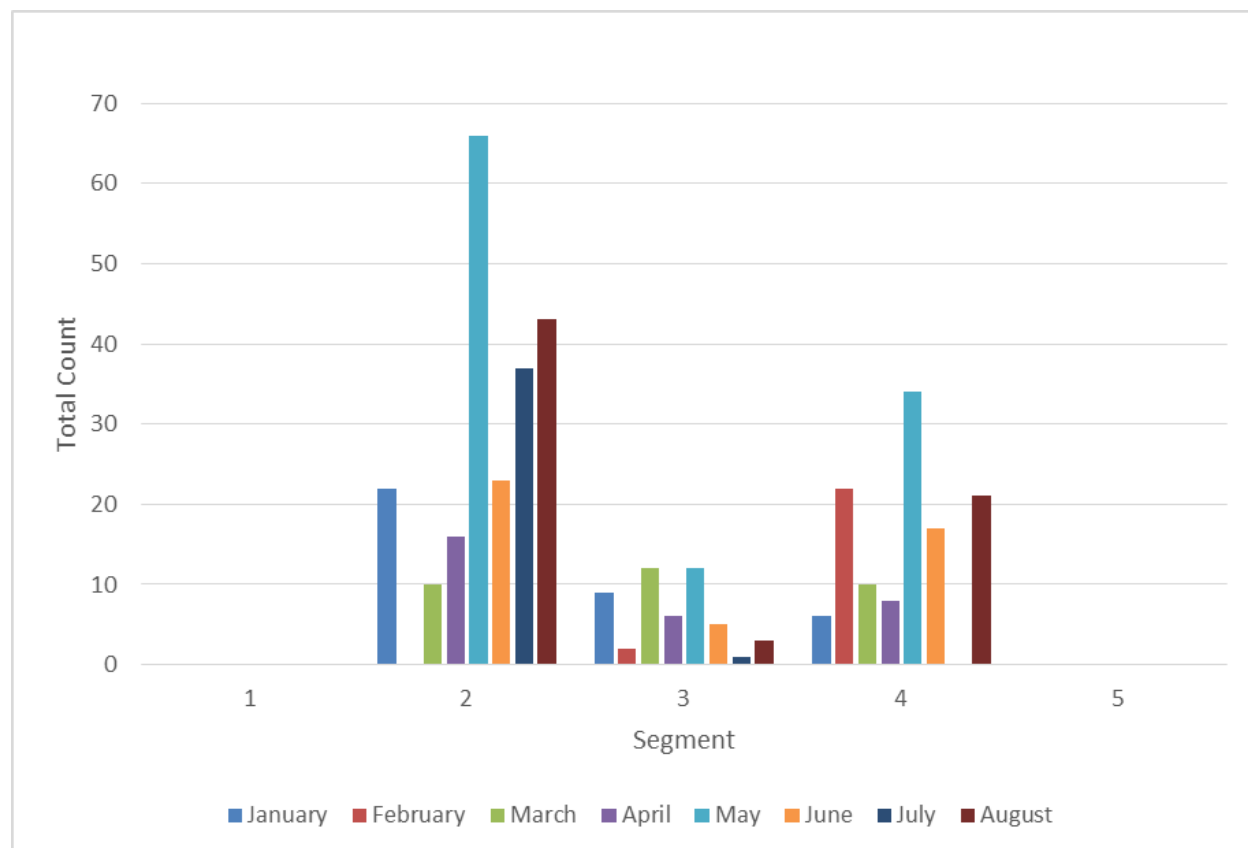
Observations of the Linac Road “territory” were consistent with the limited observations of 2014. In both years, there was apparent early activity that may have indicated territoriality or interest in establishing a territory, centered on the cliff areas approximately 0.75 miles northeast of the southeast corner of Site 300. On January 26, 2015, we observed attempts at courtship in this area

by a subadult female and at least two adult male golden eagles. In early March, a large stick nest was observed at the center of this cliff area; however, by March 25, 2015 we confirmed that the nest was occupied by a pair of common ravens (*Corvus corax*). No subsequent surveys revealed any evidence of a territory in the Linac Road area. Aside from the occasional eagle passing through or extended activities of the Tesla territory pair, no activity observed in this area indicated the presence of eagles from another occupied territory. In fact, we observed territorial behavior to indicate that the suspected Linac Road activity center may actually be included in the Tesla territory. On August 13, 2015, an eagle from the Tesla pair appeared to usher another adult golden eagle south, through the suspected Linac Road activity center. The Tesla adult undulated over the cliff area, then proceeded to soar high over the south side of Site 300, and eventually set its wings and flew out of view over the west side of Site 300, toward the center of the Tesla territory.

### ***Ground Squirrels at Site 300***

Ground squirrel activity at Site 300 appeared to be limited to the northern two-thirds of the property, with colonies surrounding the north end of the Central Ridge. These areas coincided with routes 2, 3, and 4. No squirrel activity was observed along routes 1 and 5. While there was a slight increase in squirrel observations during the month of May, the time of day and month were not significant factors in predicting these trends (Figure 4).

**Figure 4. Total number of ground squirrels observed by study segment and month.**





## Discussion

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There was consistency in observations between 2014 and 2015 golden eagle surveys. Observations made in 2015 solidified our understanding of the golden eagle ecology at Site 300. The suspected Linac Road territory has not been consistently occupied since the beginning of surveys in 2014. There is no evidence to support of the existence of a Linac Road territory. Conversely, the Tesla territory is a consistently occupied golden eagle territory, which covers most of Site 300 and up to a few canyons west of Site 300. The territorial adult golden eagles consistently occupy and defend hunting areas in the vicinity of the Site 300 Central Ridge. They were also observed to regularly undulate over areas west of Site 300 and would often drop out of sight beyond the ridgeline approximately one mile to the west. All further discussion, unless otherwise stated, is in reference to the Tesla territory.

The Tesla territory did not appear to change in size or shape over the course of the nesting season. Perching and territorial behavior was observed throughout the season, with hunting activity primarily focused within Site 300. Not surprisingly, no nesting activity was observed within Site 300, which does not contain suitable stands of potential nest trees. Tesla Ranch, however, does provide ample suitable nesting habitat with multiple mature valley oak (*Quercus lobata*), and gray pine (*Pinus sabiniana*) present in isolated canyons west of Site 300. We suspect that any nesting of the Tesla eagle pair will occur in this habitat. Unfortunately, this area is only visible from points outside Site 300 with limited access approximately 1.75 miles to the south. No nest-building or the presence of suspected eagle nests in any of these trees could be confirmed. Future survey efforts should attempt to establish contact with the Tesla Ranch landowners and gain access to these areas for more close-range observations.

Site 300 contains certain features that make it suitable for year round occupation by territorial eagles. The Central Ridge, located approximately at the center of Site 300, is surrounded by high quality foraging habitat in the two main valleys to the east and west. Ground squirrel colonies surround the north end of this ridge, and make it a natural center point for eagle exploitation. The varied mountainous topography surrounding the Central Ridge also provides the perfect habitat for low, contour hunting bouts, in which the eagles use the changing topography as a blind in order sneak up on their preferred ground squirrel prey. From this Central Ridge location, the eagles have an added advantage of the sun at their back as they make hunting forays into the surrounding ground squirrel colony.

During hunting bouts, the golden eagles would often perch on the ground. Ground perching was generally done near the top of a hill area, and overlooking the potential hunting area. Other than the preferred Central Ridge perch and occasional ground perching, no other Site 300 perches were observed. The Tesla eagle pair were occasionally observed perched in trees west of Site 300. These observations were rare, as distance made it difficult to pick eagles out of the foliage, unless they were observed flying to these trees initially.

Another commonly observed eagle behavior was the sequence of hunting forays that followed the topography of Site 300, starting in areas north of the Central Ridge, and terminating in the southern part of the Site. The adult eagles would effortlessly soar up with rising thermal currents occurring in these areas, and glide back down to perch on the Central Ridge wooden power pole. This behavior was consistently observed throughout the year.

Hunting activity was not observed on the south side of Site 300. This is likely due in part to the lack of ground squirrels in this area. The golden eagles that occupy Site 300 appear to utilize areas that provide an abundance of prey, in the form of California ground squirrel colonies. All observations of hunting were centered on areas where ground squirrel activity was consistently observed. Areas without ground squirrel activity were primarily used by eagles for soaring or direct flight elsewhere. The ground squirrel data collected in this study supports the conclusion that golden eagle use of Site 300 is primarily driven by the presence of prey.

Non-territorial adult golden eagles (floaters) were not regularly present at Site 300. Based on their behavior, most observations of adult golden eagles within Site 300 were identifiable as the local, territorial adult birds. Non-territorial adults were either observed to be in transit unmolested over Site 300, or they were in the process of being escorted out by one of the territorial adults. Floaters did not appear to be tolerated by the territorial birds. However, most escorts or territorial displays appeared to be directed at subadult birds, which were by far the most common, non-territorial golden eagles present on Site 300. Subadult golden eagles were generally escorted out of the area, though some interactions were not overtly antagonistic. In some instances, a territorial adult would simply fly over, soar with the intruder, and then move on. At other times, the presence of a subadult eagle would elicit an immediate bout of undulations, followed by chasing. At still other times, we observed subadult golden eagles soaring over the adults perched on the north side of the Central Ridge, with no apparent reaction on the part of the adults.

In many instances, individual golden eagles were recognizable by variations in plumage or molt patterns. When observed, these patterns were noted and subsequent observations of the same plumage or molt patterns were assumed to be the same individual. Molt was not always observed, such that recurring individuals may have been misidentified as new eagles. This was especially likely to occur with non-molting adult golden eagles and perched birds, and may account for variation in total numbers of eagles seen in a given month (Table 1). For example, in January 2015, 11 adult, 6 subadult, and 5 unknown age golden eagles were observed. As many of these observations were at a distance, or of perched individuals that subsequently flew out of sight, these numbers may not represent the actual number of golden eagles present in the area. Given difficulties in identifying individual eagles, and the generally low numbers of eagles observed in a given month (between 5 and 22) drawing conclusions about fluctuations in eagle activities over the course of the year is difficult.

In general, we may expect higher visibility of golden eagles during times of increased courtship-

related activity (territorial birds undulating across the territory, soaring, and copulating on prominent perches), as well as peaks in migration activity (additional individuals moving through). On the other hand, in a regular breeding year, the territorial golden eagle pair may become quite cryptic during the 6-week incubation period, leading to decreased total observations. Such fluctuations in eagle activity may account for the slight peaks in total eagle numbers observed in January (courtship), and April (migration). However, it is difficult to draw conclusions from the relatively low numbers of eagles observed in May. Observations of the Tesla pair perched and soaring together for extended periods throughout the year indicate a non-breeding year.

As stated previously, golden eagle activity was concentrated in areas that supported ground squirrel colonies. These ground squirrel data present a good baseline of information in this regard. The ground squirrel surveys were however, not perfect. In most cases, the ground squirrels were detectable if they were present above ground. However, some surveys – particularly on hot afternoons – detected no ground squirrels along any of the survey routes. Ground squirrel detectability was also likely affected by distance from the observer, however in the interest of simplifying the data collection and analysis, we did not collect distance-related information. There were some routes where the topography prevented viewing of high-density ground squirrel areas. In particular, the north half of route 4, which includes the final ascent to the WOP passes a regularly hunted ground squirrel colony. This colony is completely out of view below the shoulder on the down-hill side of the road.

Ground squirrel colonies also coincided with areas where controlled burns had occurred. While the removal of tall grass may have increased observations of squirrels in these areas, determining relationships between burn activities and presence of ground squirrels was beyond the scope of this study.

### ***Future Study***

Golden eagles utilize Site 300 on a daily basis throughout the year. Territorial eagles defend a year-round hunting territory surrounding the north side of the Central Ridge and likely a nesting area in the tree-filled canyons west of Site 300. Site 300 is also regularly visited by other individual eagles that stop to hunt or transit through enroute to other locales. These latter eagles may remain for short periods, but are generally ushered out of the area by the local territorial pair. Site 300 offers a great opportunity to follow the daily life of a central California pair of resident golden eagles. Confirmation of nest location would greatly enhance our knowledge of this territory, which appears to be twice as large as the average territory size just of golden eagle territories located southwest of Site 300. Future studies comparing territory size in relation to the presence of nesting structures and/or hunting areas would improve our understanding of the ecological pressures faced by territorial golden eagles. The Tesla golden eagle pair would also be a good candidate for a telemetry study, with which micro-scale habitat use and range data could be collected. Telemetry could also facilitate location of the nest site on the adjacent and inaccessible ranch land. Knowledge of the nest location, home range and habitat use would allow for a greater

understanding of the potential threats of surrounding wind energy in the Altamont Pass Wind Resource Area as well as other potential unknown factors that affect these eagles.

Site 300 and surrounding areas also offer an opportunity for controlled studies of the relationship between golden eagles, regularly scheduled controlled burns, intermittent fire, and prey population studies. Studies that map and quantify ground squirrel populations within Site 300 and the effects of annual fires on these populations would be useful in informing wildlife management in the California central coast range at a landscape level as well as for Site 300 managers.

We recommend annual monitoring of the Tesla golden eagle territory. A survey effort that spans the breeding season could document their breeding cycle and provide baseline information on the phenology of their nesting cycle including the incubation period and fledging dates. These surveys could require 10 to 15 visits during the breeding season to confirm territory occupancy status, nesting success and juvenile use of Site 300. In lieu of annual surveys, eagle territory occupancy surveys should be conducted at least once every 3 years, or after major, landscape-altering events such as wildfire or development.

## Appendix A: 2015 Site 300 Golden Eagle Survey History

Date	Survey Type	Location	Start	End	Total Time (hours)	# GOEA	Notes
1/8/2015	Point Count	EOP, WOP, 849, LRD	8:00	15:30	7.5	0	
1/26/2015	Golden Eagle	WOP, LRD	9:45	16:30	6.75	14	
1/27/2015	Golden Eagle	849	10:00	16:30	6.5	11	
2/11/2015	Point Count	EOP, WOP, 849, LRD	8:00	15:30	7.5	1	
2/19/2015	Golden Eagle	EOP, WOP, 849, LRD	9:45	14:00	6.25	0	Fog
2/23/2015	Golden Eagle	Carnegie State Vehicle Recreation Area	10:30	16:00	5.5	10	
3/24/2015	Golden Eagle	WOP, 849	10:00	15:00	5	6	
3/25/2015	Golden Eagle	LRD, WOP	10:30	15:30	5	4	Suspected nest on firecracker cliff occupied by CORA
3/26/2015	Point Count	EOP, WOP, 849, LRD	8:30	15:30	7	1	
4/14/2015	Point Count	EOP, WOP, 849, LRD	8:15	15:15	7	8	
4/21/2015	Golden Eagle	Carnegie State Vehicle Recreation Area	1030	1530	5	4	Started on road OP on Alameda Property, then moved to ridge within CSVRA, South of Site 300
4/22/2015	Golden Eagle	WOP	11:00	15:30	4.5	4	
5/11/2015	Golden Eagle	WOP	10:00	15:45	5.75	2	High winds, many young ground squirrels observed
5/19/2015	Golden Eagle	Black Butte with Patrick	8:30	12:30	4	0	
5/20/2015	Point Count	EOP, WOP, 849, LRD	7:30	15:00	7.5	3	
6/16/2015	Point Count	EOP, WOP, 849, LRD	8:00	15:30	7.5	5	
6/29/2015	Golden Eagle	WOP	10:00	15:00	5	4	
6/30/2015	Golden Eagle	WOP	9:00	14:00	5	4	
7/28/2015	Golden Eagle	WOP	10:30	14:45	4.25	3	
7/29/2015	Point Count	EOP, WOP, 849, LRD	8:30	16:00	7.5	4	
8/10/2015	Golden Eagle	WOP	9:00	16:00	7	0	
8/13/2015	Point Count	EOP, WOP, 849, LRD	8:15	16:30	8.25	6	
8/17/2015	Golden Eagle	WOP	9:45	14:45	5	2	
8/31/2015	Golden Eagle	WOP	9:15	15:00	5.75	2	

**Appendix B: Site 300 Golden Eagle Observations – 2015**

Date	Time	Observer	OP	#Unknown	#Adult	#Subadult	#Juvenile	Sex	Identifying features?	Observation
1/26/2015	11:10	EPJ, TH, JW	WOP	1				U		Circling on central ridge NW of 849, drops down on E side of ridge
1/26/2015	11:20	EPJ, TH, JW	WOP	1				U		Perched on wooden power pole NE of 849, glided down NE of ridge
1/26/2015	11:25	EPJ, TH, JW	WOP		1			F	Full crop	Comes out of drainage W, soars up SW of WOP, approx, 1.5K, soars SW out of sight
1/26/2015	11:30	EPJ, TH, JW	WOP		1			M		Soars up approx 2K SW, comes nearer, undulates med/low over ridge approx. 1.5K SW, then soars up, follows Adult F out of sight to SW
1/26/2015	11:35	EPJ, TH, JW	WOP		1			U		Soars up approx 1.6K S, glides twd W, soaring up high, evt headed W to E, then back and forth to SW of OP, evt soaring over PG&E tower and distant ridge to W and out of sight, likely down to perch behind ridge approx. 3K+ W/SW
1/26/2015	12:00	EPJ, TH, JW	WOP			1		U	#5 rectrices white with dark deck feathers	soars up out of drainage approx 1K W, soars, then glides down to perch on southernmost windmill in line due W of WOP. 13:15 glides S and out of sight
1/26/2015	12:20	EPJ, TH, JW	WOP		1			U	slight notch in left 2' flight feathers	soars up 1K S of WOP, soars, then glides down to perch on highest wooden power pole on N side of central ridge; 1315 glides W/SW and disappears behind water tank and hill, approx 1K S of WOP
1/26/2015	13:00	EPJ, TH, JW	WOP			1		U		circles up W of WOP, soars 3K W and out of sight
1/26/2015	13:30	EPJ, TH, JW	WOP		2			MF		Pair circle up SW of WOP, soar, then glide W toward 2014 activity center beyond far ridge to W.
1/26/2015	14:50	EPJ, TH, JW	LRD		3	1		MMFU		1 adult male (#1)perched near top of cliff, E/NE of OP, 1 sub-adult female (#2) lower on the cliff, nearby, the adult male flies out, then back into a nook, from which flushes a third, adult male eagle (#3), which flies to another perch. A coyote runs up and chases #2 off, then pokes around and eventually flushes #3 again. #s 1 and 3 both take flight with #1 chasing #3; they lock talons and drop to the ground. Both run uphill a bit with #3 taking flight and #1 chasing; both disappear around hill E of OP, headed S. #2 perched on cliff still, but then chased off by coyote. #2 flies NE to a PG&E tower, where another adult GE (#4) is perched, and perches lower in the tower. #2 then flies over to a nearby PG&E tower, where there is a potential nest, then flies to perch next to #4, #4 takes off to next tower S, as if uninterested in #2.
1/27/2015	10:20	EPJ, TH, JW	849	1				U		Perched on knoll ~3.14 mile W of 849 OP, .5 mile SW of PG&E Tower on Tesla property, 11:05 this bird glides down the canyon SE, twd Site 300, mobbed by CORA, glides further down canyon to ground, evt. Out of sight west of Site 300
1/27/2015	10:50	EPJ, TH, JW	849	1				U		Lazily flies over to S, and out of sight
1/27/2015	11:30	EPJ, TH, JW	849	1				U		Contouring around hill and water tank W of 849, on the W side of Site 300, lands on ground, not a good look at tail, likely adult, 1135 out of sight, headed low twd WOP, 1137 back in view on N side of water tank hill, perched on ground. 1245 took off, flew NE, behind hill twd Do-All Road
1/27/2015	12:45	EPJ, TH, JW	849		1			U		Soared out of the SW, all over, then W and out of sight by Eagle Run
1/27/2015	12:45	EPJ, TH, JW	849			1		U		Soaring overhead, dropped down on E side of Central Ridge.
1/27/2015	12:50	EPJ, TH, JW	849		2	1		UUU		All three eagles on ground E of Do-All Road, S of EOP, all out of sight by 1255

Date	Time	Observer	OP	#Unknown	#Adult	#Subadult	#Juvenile	Sex	Identifying features?	Observation
1/27/2015	13:25	EPJ, TH, JW	W of Central Ridge			1		U		Subadult lands on pole NW of 849, on ridge btwn 849 and WOP (observed while driving)
1/27/2015	13:45	EPJ, TH, JW	Do-All Road		2			MF		Eagle pair perched on wooden power poles on N side of Central Ridge, full crops, both took off and flapped W, twd Tesla Ranch
2/11/2015	11:20	EPJ	LRD		1			U		On south side of cliffs, NE of firecracker (observed during point counts)
2/23/2015	10:40	EPJ, BMW	CSV RA		2	1		MFU		Pair (Tesla) soaring S of WOP with young sub-adult, Adult male undulates from Tesla PG&E tower down canyon to 849 and Corral Hollow Road: Border Patrol, Adult female perched on top wooden power pole on N side of Central Ridge. 1100 Female glides off to W and out of sight.
2/23/2015	11:00	EPJ, BMW	CSV RA	1				U		Unknown eagle perched on wooden power pole at top of N Central Ridge, assume one of Tesla pair. 11:45 glides N and out of sight.
2/23/2015	12:20	EPJ, BMW	CSV RA		2			MF		Pair (Tesla) soaring high over NW corner of Site 300. The adult female glides to the ground at the top of the W ridge, by the PG&E tower, The adult male keeps soaring, undulating over the canyon W of Site 300, and then down to the female - Copulation - 1235 one eagle flies low, twd Site 300, evt out of sight in valley W of Central Ridge. 1310 2nd eagle drops out of sight.
2/23/2015	13:10	EPJ, BMW	CSV RA		1			U		Perched on wooden power pole on N side of Central Ridge
2/23/2015	14:15	EPJ, BMW	CSV RA		1			U		Glides E under cliff area, mobbed by RTHA, continues over toward central ridge area and out of sight.
2/23/2015	15:40	EPJ, BMW	CSV RA		1			U		Undulating low over NE side of WOP
2/23/2015	15:55	EPJ, BMW	CSV RA		1			U		Lazily soaring and hunting/scanning S of WOP
3/24/2015	10:00	EPJ, BMW	En route to WOP		1			U		Soaring over vehicle in Site 300 W valley (observed while driving).
3/24/2015	10:34	EPJ, BMW	WOP	1				U		Soaring high with CORA pair over repeater on E Ridge of Site 300, high soar N, over I580, then back SE, evt out of sight way more distant E of E Ridge.
3/24/2015	10:59	EPJ, BMW	WOP			1		U		Young sub-adult contouring N of WOP, around hill and out of sight.
3/24/2015	11:20	EPJ, BMW	WOP		1			M	Molt in #5 R 1'	Contour hunting E of WOP, then under favorite perch on N side of Central Ridge, SW into W Valley, circles up on W side of 849, contour hunting along W ridge, then back to Central Ridge and out of sight. 1150 back up soaring and contouring between areas N and W of Central Ridge. One undulation on S side of Site 300, SE of WOP. 12:45 soars up and S of WOP, gets height, mobbed by RTHA, the drops E to perch on wooden power pole on N side of Central Ridge. 1302 off perch headed SW down ridge, then back N, behind near knoll and the SE. 1310 flies W/SW twd

Date	Time	Observer	OP	#Unknown	#Adult	#Subadult	#Juvenile	Sex	Identifying features?	Observation
										Tesla Park and out of sight behind the W ridge.
3/24/2015	14:15	EPJ, BMW	849		1			U		Soaring over W valley, dives twd N side of Central Ridge and out of sight.
3/24/2015	15:00	EPJ, BMW	849			1		U		Soaring and then down, out of sight NE/N of 849 OP.
3/25/2015	11:30	EPJ, BMW	LRD, WOP		2			MF	M: Molt in R wing, full crop	Pair perched on wooden power pole on top of N side of Central Ridge. ~1150 Male began soaring over perch area, then flies back to perch with female. (1220 young sub-adult flies over, no reaction from pair), 1250 male off perch, glides out of sight behind near knoll. 1255 pair up and soaring, then glide NE twd the Safeway windmills, then soar high, glide W to high ridge past PG&E line, both undulate, then soar S over Tesla area, then north. 1323 Male undulates all the way back over WOP to perch on N side of Central Ridge. Female still W. 1325 Male undulating low, by perch poles, then perched again on 3rd wooden power pole down from top, female soaring to west. 1330 male up, soaring above central ridge, female out of sight to west, male sets wings and soars over WOP, twd west, soaring lazily until 1416 and out of sight to NW, twd Patterson Pass. 1345 Male back on favorite perch. 1430 Male out of sight. 1453 male soars SW to N, undulates high N of WOP, soars S, undulates back to favorite perch (possible response to sub?). 1515 Male off perch, stoop to N, NE side of ridge and out of sight.
3/25/2015	12:20	EPJ, BMW	WOP			1		U	Lots of white in tail	Young sub-adult glides high from N to S over Central Ridge (no reaction from perched pair)
3/25/2015	14:45	EPJ, BMW	WOP			1		U		Hunting SE of WOP, headed SW
3/26/2015	9:00	EPJ, BMW	LRD, EOP		1			U		Perched on favorite perch on N side of Central Ridge
3/26/2015	15:13	EPJ	849		1			U		Gliding approximately 800m SE, twd W
4/14/2015	8:16	EPJ	WOP		1			U		N of WOP, gliding SE, then back SW, mobbed by CORA
4/14/2015	8:21	EPJ	WOP			1		U	bit of white in tail - S3-4	Contour hunting back and forth along W ridge, W of WOP, then over to valley just E of WOP, NW of Central Ridge, evt out of sight over ridge to NE of WOP (8:40)
4/14/2015	8:44	EPJ	WOP			1			young - lots of white in tail	Contour hunting in valley NE of WOP, mobbed by an adult female NOHA, evt soaring to NW and out of sight. (8:50)
4/14/2015	8:50	EPJ	WOP		1	2		UUU	Near-adult (#5 R tail feather white), Sub-adult (moderate white in tail), adult (no white)	Loose flock of two sub-adults and one adult surfing/contouring from SE to NW, past NE side of WOP, following line from E side of Central Ridge to NW side of Site 300, near adult is mobbed by ad female NOHA



Date	Time	Observer	OP	#Unknown	#Adult	#Subadult	#Juvenile	Sex	Identifying features?	Observation
4/14/2015	9:00	EPJ	WOP		1	1		UU		Soaring NE of WOP, glides down to perch on wooden power pole on N side of Central Ridge, then back up soaring back and forth over NE and NW side of WOP, evt flapping SW, chasing a sub-adult golden eagle out of sight toward SW corner of Site 300 (09:15)
4/21/2015	12:30	EPJ, BMW	CSV RA		2			MF		Pair soaring and undulating over N side of Central Ridge, the adult male perches on the wooden power pole while the adult female soars S to 849 and back, then both glide out of sight near the WOP. Some more sightings of this pair up and down in this area over the next hour.
4/22/2015	10:45	EPJ, BMW	WOP		2			FM	F: some molt in L #10 2's and L#1 1's.	Perched on top wooden power pole on N side of Central Ridge. 1100 off pole, soaring over S side of WOP, glides W over distant W ridge, undulates, soars back 1/2 way, undulates, soars back W, undulates again, then finally glides back to perch at top of Central Ridge, next to male GE at 11:20. 11:37 the male drops below SE side of Central Ridge and out of sight. 1145 the male appears in sky in the W side of the territory, SW of WOP, glides to perch with female. 1200 the male makes a contour hunting foray into the valley NE of the WOP, after 10 minutes with no luck he goes back to Do-All Road, undulates, then perches with the female. 1223 the female glides W, behind the near knoll SE of the WOP. 1230 the male flaps to the water tank on the Site 300 W ridge, S of the WOP, soars, then stoops on ground squirrels SW of the OP, then meanders twd Do-All Road and out of sight. 1233 the female soars up to SE, over the OP, then glides back to perch at the N side of the Central Ridge. 1242 the male sweeps in to perch next to the female. 1250 the male flies hard to the water tank on the west ridge, hunts his way back to Do-All Road, then circles up to perch on wooden power pole 4 poles below the female, which is at the top of the ridge. 1303 the male vocalizes, then off after prey to the SW, behind the near knoll. 1305 the female hops off her perch, undulating E of the Central ridge. 1308 the male soars up over the perch, undulates, joins the female, and both soar. the female then perches, while the male undulates and then perches with the female. 1325 - more vocalizing. 1340 vocalizing, (1321 -two subadult eagles soar over WOP, twd W while the pair remain perched). 1345 male takes a short flight, then back to perch. 1347 the female takes off, goes behind the ridge and out of sight. 1350 the male flies to the S end of the W valley, hunting up to water tank of W ridge, and back S. 1353 female back on perch. 1403 male soars up, S of the W valley, the glides back down to perch. 1410 male flies to ground squirrel area NE of OP, catches a squirrel below the WOP, flies a short hop, then eats, while the female remains perched. 1421 the male is up, full crop, undulating over feeding area, female is off perch, both soar S of the WOP, undulate, soar W, past the PG&E power line and ridge, then undulate out of sight. 1454 female back on perch on N Central Ridge.
4/22/2015	13:41	EPJ, BMW	WOP			2				Soaring over WOP, twd W, while the adult pair remain perched on N side of Central Ridge
5/11/2015	10:35	EPJ, BMW	WOP	1				U	Either really blond in tail or sub-adult	Soaring into wind SW of WOP
5/11/2015	13:07	EPJ, BMW	WOP			1		U		Soaring with CORA W of WOP, turned and glided S, twd CSVRA, hangs in wind

Date	Time	Observer	OP	#Unknown	#Adult	#Subadult	#Juvenile	Sex	Identifying features?	Observation
										on S side of Site 300, then out of sight.
5/20/2015	13:11	EPJ	WOP		2			P	#1 with full crop	350m SE of WOP then contouring/gliding back and forth SW of WOP, mobbed by adult RTHA then joined by 2nd adult, from 100 W, both glided S
5/20/2015	13:34	EPJ	WOP		1			U		450m S diving NW, then 400m SE, contouring W,
6/16/2015	11:00	EPJ	EOP		1	1		UU	Subadult=2nd year bird in heavy molt	Adult and young subadult in heavy molt over Central Ridge, adult appears to be trying to gain height to get to subadult
6/16/2015	11:40	EPJ	EOP		2			MF		Pair perched on wooden power poles on top of Central Ridge. One on top pole, other on 3rd pole down. Remained perched through 12:15
6/16/2015	12:53	EPJ	WOP		1			U		Gliding E of WOP, headed SW
6/29/2015	10:08	EPJ, BMW	En route to WOP		1			U		Contouring on slope E of favorite Central Ridge perch
6/29/2015	10:41	EPJ, BMW	WOP		2			MF	Male: heavy molt, Female: just a little molt in 2's	Pair circle up from E end of Do-All Road, soar high over Site 300, 1047 Male glides SW down ridge and is lost against distant hillside. Female glides W, over hill between windmills and PG&E Tower. 1056 Female perched on 2nd wooden power pole from top, N Central Ridge, 1130 Female circles up, joined by Male from NW of WOP, Female undulates over central ridge and again over ridge NW of Site 300, then both glide NW and out of sight. 1203 Male flaps low from W/NW, aiming for SY eagle, both soaring high NW of EOP, 1208 Male leaves juvenile eagle, heads W, twd Tesla property, undulates, and drops below the horizon. 1220 Male flaps from W to E, N of the WOP, then glides to Central Ridge, soars high to SE, and out of sight.
6/29/2015	12:03	EPJ, BMW	WOP			1		U	2nd year by tail molt	Flapping through below WOP to NE, circles up and soars between WOP and EOP, joined by Tesla Male, both soaring NW of EOP, 1208 glides NW and out of sight.
6/30/2015	10:08	EPJ, BMW	WOP			1		U	S2-3	Flying W of WOP, contours NW of WOP, then soars, headed NW, circles back, stoops into valley NW of EOP and out of sight. 1054 back up with a full crop, soaring N of WOP, over the WOP, then NW, then W, 1100 met by one of territorial pair, they soar together NW of WOP, adult drops down and sub-adult meanders off to the W/NW twd Patterson Pass
6/30/2015	10:41	EPJ, BMW	WOP		1			U		Soaring SE of WOP, head down and scanning, evt drops down behind ridge W/NW of EOP, right where the sub-adult eagle had dropped.
6/30/2015	10:55	EPJ, BMW	WOP		2			MF		Two adult eagles soaring a few miles NW of WOP, one branches off and glides over to meet soaring sub-adult, they soar together then the adult glides down to perch on a post beyond the near-ground windmills W of WOP. The 2nd adult soars twd the Tesla substation, then gradually over the WOP, lazily over to LRD and Lower Elk Ravine/Firecracker facility, then back twd the process area and out of sight SE of the Central Ridge. 1115 first adult still perched on post. 1159 2nd adult (by molt) circles up ~1 mile NW of WOP, glides down ridge over W side of WOP, then glides down W ridge to Corral Hollow Road, soars up E, twd Site 300 entrance, then out of sight toward Connelly Ranch (1220), 1207 Adult on post gone.

Date	Time	Observer	OP	#Unknown	#Adult	#Subadult	#Juvenile	Sex	Identifying features?	Observation
7/28/2015	11:35	EPJ	WOP		1			U	Molt in L #7 1'	Circles up over LRD OP, gets height, takes a line NW, directly over WOP, continues without pause twd E side of Mt Diablo, never stopping until out of sight at 1157
7/28/2015	12:00	EPJ	WOP		2			MF	First to fly with molt in R #9 1'	Pair perched at top of N Central ridge. 1202 one takes off, glides NW along ridge, soars twd the Tesla Substation, then over twd Patterson Pass, back twd NE corner of Site 300, then in a steep glide out of sight NW of Site 300 (1220). The 2nd perched eagle was gone by the time the other went out of sight.
7/29/2015	9:40	EPJ	LRD, WOP		2			MF		Perched at top of N Central Ridge, 11:05 off perch, undulating low, 2nd adult glides S between WOP and Central Ridge, full crop, 1st gone, presumably followed 2nd.
7/29/2015	11:10	EPJ	WOP		1			U		Perched at top of N Central Ridge until 1245
7/29/2015	11:31	EPJ	WOP		1			U		Soaring over WOP, headed NW, twd N side of Site 300 and out of sight
8/10/2015	10:05	EPJ	WOP		2			MF		Pair hunting, soaring, undulating over central ridge
8/10/2015	14:45	EPJ	LRD		1			U		Gliding over LRD twd S, out of sight
8/13/2015	8:54	EPJ	849		1			U		Circles up W, over S side of W valley, mobbed by RTHA, then gliding NE, drops below E side of Central Ridge, glides N,
8/13/2015	9:05	EPJ	849		1			U		Likely same eagle, perched on wooden power pole on ridge between 849 OP and WOP, then dropped down on NW side of ridge.
8/13/2015	11:20	EPJ	LRD		2			MF		Perched on wooden power pole on N side of Central Ridge, 1153 gone
8/13/2015	12:32	EPJ	LRD		2			UU		Two adult eagles gliding from E ridge of Site 300 (near repeater, "double tree ridge"), upper bird undulated, then peeled off twd NE, up sub-canyon, caught a thermal, circled up, high over 871. 1245 then set wings for long glide to W, 1250 ended up disappearing over 849 OP, twd Tesla territory, lower bird glided down canyon, out of sight behind chimney,
8/17/2015	10:15	EPJ	WOP		2			MF		Pair soaring low over N end of Central ridge. Female glides SW and lost over SW corner of Site 300, the Male glides down and perches on wooden power pole on N side of Central Ridge. 1040 The male is up again, soaring over central ridge, full crop, glides across S side of WOP, then to SW corner of Site 300, picks up a thermal to W, glides W over Tesla, undulates high to W, glides N, then back S, and out of sight behind ridge behind PG&E power line (1115). 1249 Pair back perched on Top pole, N central Ridge. 1335 both birds are up again, the male is out of sight, the female soars up E of Central Ridge, gets really high, sets wings, glides NW, just N of WOP, and on twd Mt. Diablo, lost in blue (1355).

Date	Time	Observer	OP	#Unknown	#Adult	#Subadult	#Juvenile	Sex	Identifying features?	Observation
8/31/2015	9:25	EPJ	WOP		2			MF		Pair perched at top of N Central ridge, 0943 female drops out of sight behind E side of ridge, male remains perched. 1015 male off perch flying on N side of ridge, female up, over him, with full crop, both soar a bit, then back to perch, female @ #2, male @ #3 pole from top. 1025 Male makes a fast stoop across Do-All Road, along ridge NE of WOP, contours super-fast along squirrel colony area and contours out of sight through saddle, N of WOP. 1031 Male back over on SW side of same ridge, contours SE over Do-All Road, up a bit, the contours down N side of Central Ridge, crosses line twd W Valley. 1038 Male in glide against 849 Communications Tower, presumably circled up near S side of Site 300, glides back to perch. Female up and soaring S of WOP, gets to eye level, then glides over water tank, soars SW, evt perches in valley oak SW of WOP, with distant PG&E tower in background (mid-distance knoll ~1.1 Mile SW of WOP). 1110 Male up for a moment, then back down on top pole, N Central Ridge. 1125 Male gone, female still in tree. 1130 Male on 4th pole down ridge. 1135-1142 Male contour hunts up central ridge to N side of Site 300, back down to perch area, Do-All Road, back and forth a few times, evt. back to perch on 3rd pole down from top. 1145 Female still in Oak. 1205 Male up to #2 pole, 1207 Male up to top pole, displaces CORA. 1306 Male soars high, sets wings, glides W to perch on a non-spinning windmill, 4th windmill from S, on 1st ridge W of WOP. 1326 all eagles out of sight.